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Infant's Food.

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THE QUALITY AND QUANTITY OF AN INFANT'S FOOD.*

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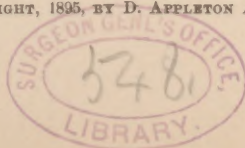
GIVEN a healthy baby, one that has successfully passed the upper and lower narrows and disembarked from the troubled waters without bruise or blemish, what treatment has this child a right to demand at our hands during the earlier months of its existence, first as to the quality, and again as to the quantity of food it shall receive at each nursing? These are the two specific problems that shall demand our exclusive attention, realizing that we are dealing with the healthy and not the sick child.

It also seems opportune that we should give our best thought to this subject at this particular time of year, when we are brought face to face with a high infant mortality, a mortality that we can only too often directly trace to errors in diet that might have been avoided.

I say, what treatment has this child a *right* to demand? If the mother is in good health, with sound nipples and a

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good flow of milk, the child's right is unquestionably clear and plain. The time has not yet arrived, nor do I believe it will ever come, when the refinements of the laboratory can improve upon Nature's method of rearing her young. I have no sympathy with the mother who, under such circumstances, refuses the nourishment specially designed by Nature for that special child; far better for her not to enter at all upon the obligations of married life than to shirk what is her plain duty and what ought to be her pleasure.

And yet, willing or unwilling, the presence of certain conditions would contraindicate the following out of Nature's plan. Syphilis and tuberculosis are very positive barriers in the best interests of both mother and child. Again, we meet with cases where the mother appears perfectly healthy, the quantity of milk sufficient, and yet the child does not thrive. In all such cases it is our duty to make a careful analysis of the milk, and for this purpose Holt's apparatus is the most convenient and accurate for the busy practitioner. If the sample, taken from the middle nursing, shows a specific gravity of 1.018 to 1.024 and a cream of only two or three per cent. the case is hopeless.

But with the growing demand of our enlightened civilization, breast nursing, especially among the better class of people, is becoming more and more a thing of the past. Artificial feeding has come, and has come to stay. How we can best adapt ourselves to these forced conditions is the problem that presents itself to us to-day, and our success or failure in its solution will depend upon the exactness with which we can make our artificial food correspond with Nature's product.

We will first consider the character and quality of our substitute food. Cow's milk, taken from the mixed product of the dairy and not from any one single cow, should

be our main reliance. It is moderately uniform in quality, can always be obtained at a reasonable cost, and can be made to resemble mother's milk more closely than any other preparation. And yet the difficulty of obtaining a pure, fresh supply, one that is absolutely reliable, especially in the warm summer months, has been in the past and is still a serious problem.

Most excellent work, along these very lines, has been done in our own State during the past few years by Dr. Henry L. Coit, of Newark. With the co-operation of the physicians of Essex County, a model dairy has been established about six miles from Montclair. The herd is regularly inspected by a skilled veterinarian, and all animals presenting even a suspicion of disease are rejected. The character of their pasturage and food is carefully supervised. The cow's udder and the hands of the milker are subjected to a most thorough cleansing before each milking, and the milk itself passes first through a strainer into a closed pail, and thence immediately to a cold storage apartment. The services of a bacteriologist are constantly employed to determine the number and character of the bacteria present. The owner of the dairy places himself under heavy bonds to see that these regulations are faithfully and strictly carried out, and in return the physicians promise him their aid and co-operation. In this way the initial, primal supply is rendered almost absolutely pure and at a cost of only a trifle more than the regulation prices. Dr. Coit writes me that the undertaking is a most marked success in every way, and there is no reason why such a plan should not be put in successful operation in other large towns. A tour of inspection to the different dairies, such as I made last summer, and a close observation of the methods of milking and the care of the cows, will impress one with their absolute filthiness and neglect

of many of the commonest laws of decency. And yet this is almost the sole food supply for a large portion of our population. We have it in our power, as physicians, to remedy this evil. Dr. Coit and the physicians of Essex County have shown us the practical working success of a model dairy, and I believe the day is not far distant when we will demand and secure similar advantages throughout the State.

But in order to make our cow's milk approach the normal standard of breast milk it needs modifying, and we need, ourselves, definite, clear ideas as to the exact chemical composition of each.

	Woman's milk.	Cow's milk.
Reaction.....	Alkaline.	Acid.
Coagulable albuminoids	Proportionately small.	Large.
Coagulated by acids.....	Not perceptible in test tube.	Very marked ; not perceptible when diluted
		1 to 5.
Water.....	87 to 88	86 to 87
Total solids.....	12 to 13	13 to 14
Fat.....	4	4
Albuminoids.....	1	4
Milk sugar.....	7	4·5
Ash.....	0·2	0·7
Bacteria	Not present.	Present.

The foregoing table, prepared by Dr. Rotch, of Boston, gives the result of careful analysis of breast milk, taken from the middle nursing, compared with cow's milk about twenty-four hours' old.

It will be seen at a glance that the main difference lies in the albuminoids, the milk sugar, and the reaction, the fat remaining the same in each case. But reduce the albuminoids to their proper proportion and our fat and milk sugar suffer.

Dr. Meigs, of Philadelphia, was a pioneer in solving this problem, and he has furnished us with a formula which, slightly modified, is one of the best we have to day. I say the best, because it corresponds most closely with mother's milk, and the proportions are so very simple and easy to remember :

Milk	1 part ;
Cream	2 parts ;
Limewater.....	2 “
Sugar water (3 j to $\bar{3}$ j).....	3 “

The reaction is alkaline, the albuminoids are reduced to one per cent., the fat and milk sugar both in proper ratio.

Originally under the supervision of Dr. Rotch, of Boston, there have been started in our large cities milk laboratories where the acme of refinement and accuracy has been reached in the matter of infant feeding. The milk reaches the city from a model dairy in the suburbs about six hours after milking ; it is then separated into its various constituents by delicate machinery and synthetically reconstructed according to the needs of each individual baby, as indicated by the prescription blanks, which are filled out by the physician in attendance and then sent to the laboratory.

The ability to thus regulate the albuminoids in the earlier weeks of life, without diminishing at the same time either the fat or sugar, is one of the most admirable features of our prescription laboratory.

A few drops of acetic acid added to a test tube of mother's milk produce no appreciable curd ; to the same amount of undiluted cow's milk, large thick white curds are immediately precipitated, and it is only when the dilution is carried as far as one to five that we escape this mass coagulation. Excessive albuminoid digestion, and the resulting inability of the stomach to cope with the tough coagulum, I believe, is the starting point of many of our

gastric disorders. With newborn infants it has been my custom, and invariably with good results, to reduce the albuminoids as low as a half of one per cent., gradually working up to the standard at the end of a few weeks.

The milk laboratory is a scientific, rational method of infant feeding—a method which has already gained a firm foothold in Boston, New York, and Philadelphia, and one that has come to stay. The total amount necessary for the twenty-four hours is delivered each morning in separate bottles that have all been sterilized and neatly packed in wicker baskets.

So far, we have imitated Nature in the preparation of our food, as far as the ratio of the different ingredients is concerned. But mother's milk is absolutely sterile; cow's milk under the very best auspices contains bacteria. It is interesting to know that germs are always found in the main duct of a cow's teat for a distance of half an inch from the tip, even with the very best of care. And so the necessity of either sterilization or pasteurization is at once apparent. Personally the writer prefers the latter method, mainly because the product is more palatable to the child. In a series of experiments carried on by Dr. R. G. Freeman, of New York, it has also been found to be equally efficacious in destroying the disease-producing germs.

The doctor's pasteurizer, specially designed by him for this purpose, makes the details of the process very simple and within the mental grasp of the dullest nurse; or an ordinary Arnold steam sterilizer, with a perforated lid, answers the same purpose.

We have said nothing so far of the different artificial foods, whose number, like the different cures for whooping-cough, is legion. I am opposed to their use in a healthy child, because they introduce into the infant's stomach elements which Nature never intended to be put there. Again,

analyses made from time to time often show a marked variation in their composition. Commercial enterprise, and not the good of the infant, is the governing motive of the manufacturers. As a result the public suffers.

Of the different preparations I am inclined to give condensed milk a leading place. It is practically sterile and moderately uniform in its composition. It is cheap, easy to prepare, and among the poor and destitute, where cleanliness is often an unknown quality, but boiled water always a possibility, it offers many advantages. Its low percentage of albuminoids, when diluted one to twelve, gives us a food easy to digest, neutral in reaction, but lacking in potential energy by virtue of its small amount of fat. The baby apparently thrives, often grows fat, and yet I think it is a common experience with all of us that such infants lack the staying qualities which their size and appearance would give us a right to expect. The production of animal heat is very necessary to the active metabolism of the growing child, and unless we add a certain amount of cream our mixture is far from perfect. A scant teaspoonful to the ounce corrects this deficiency, and gives us about four per cent. of fat—the percentage in normal breast milk.

The use of peptonized foods, which at one time seemed destined to crowd out all other forms of feeding, is fortunately being rapidly relegated to its proper position. Its value in certain forms of gastric disturbance may be unquestionable; but Nature never intended to have this normal function usurped in the healthy child, and I believe the foundation for a weak digestion and much subsequent dyspepsia has in many instances been laid by the use of peptonized foods. Idleness means atrophy and degeneration in a gastric follicle as well as in a striped muscular fibre.

Imperial granum, Nestlé's food, and Carnrick's food, all contain unconverted starch; and why an infant only a few

days old should be called upon to digest an element for which it is totally unprepared is a mystery to the writer. We know that the starch-converting functions of the salivary and pancreatic glands only begin to be developed at about the third month. Mother's milk never contains this element, which in itself should be our warrant for withholding it absolutely.

Mellin's food, unless diluted with milk, gives us a food very low in the albuminoids and fat. Even then, with its fifty per cent. of starch converted into glucose, we are doing for Nature what she intended to do for herself. Why not add the milk sugar originally, and allow Nature, in her own good way and time, to complete the process?

And so we might go on through the long and ever-increasing list of patent foods, finding in them all either a serious omission or a meddlesome addition. They are made possible only by the tolerance and active assistance of the medical profession, and it seems to the writer that it is high time we awoke to a sense of our responsibility in the matter. The more closely we can copy Nature in our efforts to raise the bottle baby, the more successful will we be. With cow's milk, properly modified and properly prepared, I believe we have a mixture which more closely approaches the standard than any of the artificial preparations.

We now come to the consideration of the proper amount for each feeding. Our mixture may be ideal in every respect, and yet a child's health is made or marred as often by the quantity as by the quality of its food. While resident physician at the New York Foundling Hospital I became very much interested in this subject. I shall never forget one wizened, pinched little creature, only six weeks old, brought to us with the diagnosis of a "touch of marasmus," and indeed it was a "touch," for the grim monster

already had the life of the little one firmly in its grasp. "The child was a trifle fretful and nervous," the nurse went on to explain, "and we found it was quiet only with a bottle in its mouth." And so they had been in the habit of feeding this infant a mixture of six ounces every hour to an hour and a half. The bottle was no sooner emptied than it vomited the entire amount. With its hunger still unsatisfied, it cried for more, only to have the same process repeated until death came to relieve it of its misery. How often we see a repetition of this same scene! Hundreds of babies die every year from *overfeeding* where only one succumbs from being fed too little. I only wish I might have preserved this stomach as we saw it the next day at the autopsy. Dilated to three or four times its normal size by this continual stretching process, with the muscular tone so destroyed that peristalsis was no longer possible, the walls so thin that they looked like tissue paper, no wonder that all the normal functions were held in abeyance. We all know that if we subject elastic tissue to prolonged and excessive stretching, it soon loses its resiliency and refuses to return to its normal condition. And yet we seem callous to the fact that this principle holds just as true when we subject the stomach to an unnatural strain. I believe that many of our cases of dilated stomachs in after life, and atonic dyspepsias, can be traced directly to this overdistention in infancy.

Being interested to know just how much the stomach in its normal condition ought to hold, we selected children for autopsies who had died of some trouble other than gastro-intestinal. The results were most interesting, and I have brought with me this afternoon some of these stomachs, one of which has been kindly prepared by Dr. David Bovaird, and in separate bottles the amount each held by actual measurement. These measurements were made at the time of

the autopsy, and before the stomach had been subjected to the action of any hardening or preservative agents. With the pylorus closed the water was allowed to pass in through the cardiac opening from a funnel held about two feet above, insuring the natural amount of pressure. We found the size of the stomach bore a direct ratio to the size and weight of the child. Snitkin, from a long series of carefully conducted experiments, concludes that the average capacity is about one one-hundredth of the child's weight. Thus a child having an initial weight of seven pounds would have a gastric capacity of a little over an ounce, while its brother, who may have weighed twelve pounds, would have nearly double. He also found that the capacity increased at the rate of about fifteen grains a day. We found the average capacity for an average child under one month between one and two ounces; at the third month, between three and four ounces, or, in other words, a gain of about an ounce a month until the sixth month. If I ordered my grain dealer to put fifty bushels of oats in a bin that only holds ten, he would rightly deem me a fit subject for hospital treatment, and yet we constantly see nurses and mothers forcing a five- or a six-ounce mixture into the stomach of a child only a month old. The one is as rational as the other.

Another series of experiments that we carried on were of interest in determining the amount of milk a healthy child gets from the breast at each nursing. With delicately adjusted scales we weighed a series of babies at different ages, before and after nursing, and found the results corresponded very closely with the normal size of the stomach at these different periods. And just in this connection I would like to mention the advantage of weighing the babies regularly every week on an accurate pair of scales. A gain of a half to three quarters of an ounce a

day indicates that we are making satisfactory progress. Below this average something is wrong, and often it is the first index, the first straw that shows us the fact that the child is losing ground.

In conclusion, then, I would like to emphasize my belief that we are absolutely powerless to improve upon Nature's method of caring for her young. At the New York Foundling Hospital during the last twenty years the attempt has been faithfully made time and again to find a satisfactory substitute for mother's milk, only to end each time in a dismal failure. The healthful condition of the two thousand little waifs under their control is proof positive of the value of breast nursing, the only system employed there to-day.

But with the impossibility of obtaining mother's milk, we would advise the use of cow's milk, so diluted with cream, limewater, and sugar water as to form a ratio of one, two, two, and three, using this sterilized or pasteurized mixture in preference to all forms of so-called patent foods, because it resembles most closely Nature's own product.

Again and finally let us remember the normal size and capacity of the infant's stomach.

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EDITED BY

FRANK P. FOSTER, M.D.

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